Missouri Department of Conservation

Applying Research in Forestry

Forestry Division | June 1993 | Report #5

Management of Red Oak Decline in the Ozarks

Large-scale decline and mortality of red oak (primarily black and scarlet oak) in the Missouri Ozarks was first discovered in the late 1970s. During the 1980s, the affected acreages increased following a series of droughts. Early research efforts failed to identify a primary pathogen responsible for the mortality. Rather, the cause was attributed to a complex interaction of site, stand, and climatic variables followed by insect and disease attacks. Because red oaks are the most abundant and important timber and wildlife species in the Eastern Ozarks, concern exists about the future status of black and scarlet oaks.

In 1990, this study was initiated to accomplish the following objectives. First, baseline data were collected and several silvicultural options were implemented for future analysis. Second, a risk assessment model was developed and selected. Third, management guidelines were formulated based upon an analysis of site, stand, and individual-tree variables, as well as dendrochronological data.

Methodology

Two study sites were established on University State Forest, one on Deer Run State Forest, and one on Paint Rock State Forest. Each site consisted of 18 permanent, 0.50-acre square plots. On these plots, site data were collected as well as data on all stems greater than 4.9 inches dbh. Also collected were data on soil horizonation and pH, tree core samples, and both pre- and post-treatment regeneration.

The probability of individual tree survival was modelled for black and scarlet oaks. Using dendrochronology, the effect of decline on tree growth was examined. Finally, we examined the relationship between climatic stress events and decline initiation using observations of tree-ring and weather data.

Results

Both modelling procedures and other forms of analysis found that increases in competition-related variables corresponded to decreases in red oak survival and health. These variables included lower crown position and the relationship of tree dbh and basal area to surrounding stand conditions. In general, trees smaller than the stand average suffer greater stress and are more likely to succumb. This is to be expected, because larger trees receive more sunlight and have larger root systems. Such conditions may explain why scarlet oaks older than the species mean were healthier than younger trees. Also, we found that increased soil depth to hardpan was correlated to increased survival. This lends support to the belief that rooting is related to decline susceptibility.

Dendrochronological examinations discovered several relationships. First, red

Competition-related variables such as crown position appear to play a key role in red oak decline. To control competition effects in decline-susceptible stands, selection cutting may be used. Also, observation of crown conditions may allow identification of trees with superior vigor and growth.

oaks showing greater than 30 percent crown dieback had significantly lower present-day growth rates compared to trees with less than 30 percent dieback. Second, those trees with declining crowns showed significantly slower growth than presently healthy trees in the ten years following severe drought in southeastern Missouri. The dates for decline initiation varied by tree age: 1936 for 60 to 79 year-old trees and 1952 for 40 to 59 year-old trees.

A point of interest was found concerning the Paint Rock site. This site had significantly better health and lower mortality of red oaks compared to the other sites. Paint Rock also showed significantly higher surface soil pH. Whether this pH difference was the result of past fires or differing parent material is unknown. However, if the higher pH was responsible for improved health, it is noteworthy.

Recommendations

Results of this and past studies suggest red oak decline is more prominent on sites with certain soil and site characteristics, such as hardpans and upper slopes. Management of decline should focus on such areas. Also, to aid future stand vigor, more care should be taken during harvesting to avoid injuring residual trees. Most importantly, however, selective cutting should be used to control conditions in decline-prone stands. Selection cutting would allow reduction of stand stocking and individual tree competition, as well as the removal of high risk trees showing poor crowns and significantly reduced growth. This form of management could improve both the structure and composition of declining stands.

Principal Investigators:
James Wetteroff and Dr. John Dwyer, University of Missouri, This study was supported by a research grant from the Missouri Department of Conservation.

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Results and recommendations presented in this paper are preliminary but represent our best analysis at the present time. Please use this information with care.